CONGRESSIONAL AND REGULATORY TESTIMONIES:

U.S. Senate (Energy and Natural Resources Committee, Subcommittee on Water and Power; Commerce, Science and Transportation Committee); Tennessee State Legislature (Senate Finance, Ways and Means Committee; Special Joint Legislative Committee on Business Taxation; and, Senate State and Local Government Committee); Federal Communications Commission (Ex Parte presentation); Pennsylvania Public Utility Commission; Michigan Public Service Commission; West Virginia Public Utility Commission; Wyoming Public Utility Commission; Washington Utilities and Transportation Commission; Utah Public Service Commission; Wisconsin Public Service Commission; California Public Utilities Commission; Florida Public Service Commission; Delaware Public Service Commission; Montana Public Service Commission; Maryland Public Service Commission; Massachusetts Department of Public Utilities; Georgia Public Service Commission; Colorado Public Utilities Commission; North Carolina Public Utilities Commission; Texas Public Utility Commission; Arkansas Public Service Commission and New Jersey Board of Public Utility Commissioners.

SELECTED CONFERENCE PRESENTATIONS:

University of Florida, Annual Public Utility Research Center Conference, Gainesville, Florida
>   Presentation: "Universal Service in Competitive Telecommunications Markets," January 1996.

University of Michigan, "Telecommunications Infrastructure and the Information Economy: Interactions Between Public Policy and Corporate Strategy," Ann Arbor, Michigan
>   Presentation "Regulatory Policies Toward Local Exchange Companies Under Emerging Competition: Guardrails or Speedbumps on the Information Highway" (with David L. Kaserman), March 1995.

Rutgers University "Advanced Workshop in Regulation and Public Utility Economics" (Thirteenth Annual Conference, Newport, Rhode Island)
>   Presentation: "Dominant Firm Pricing with Competitive Entry and Regulation" (with Larry R. Blank and David L. Kaserman), May 1994.

Twenty-first Annual Telecommunications Policy Research Conference, Solomons, Maryland
>   Presentation: "Open Entry and Local Telephone Rates: The Economics of IntraLATA Toll Competition," October 1993.

Vanderbilt University (Owen School of Management) Telecommunications Systems Modelling and Analysis Conference
>   Presentation: "Open Entry and Local Telephone Rates: The Economics of IntraLATA Toll Competition," March 1993.

Twentieth Annual Telecommunications Policy Research Conference, Solomons, Maryland
  Presentation: "Demand and Pricing of Telecommunications Services: Evidence and Welfare Implications," September 1992.

Ohio State University (National Regulatory Research Institute) "Telecommunication Demand Conference"
  Presentation: "The Economic Welfare Effects of Extended Area Telephone Service." August 1992.

University of Utah "Conference on New Directions for State Telecommunications Regulation"

  Presentation: "Competition for Local Exchange Service--Is Nothing Sacred?" February 1991.

Rutgers University "Advanced Workshop in Regulation and Public Utility Economics" (Ninth Annual Conference, New Paltz, New York)
  Paper presented: "Demand, Pricing and Regulation of Cable TV Services: Evidence From the Pre-Deregulation Period" (with Yasuji Otsuka), June 1990.

University of Kansas "Stakeholders' Symposium on Telecommunications"
  Presentation: "The Modern History of Telecommunications Economics and Policy," Semi-annual February 1990-present.

Rutgers University "Advanced Workshop in Regulation and Public Utility Economics" (Eighth Annual Conference, Newport, Rhode Island)
  Paper presented: "The Political Economy of Deregulation: The Case of Intrastate Long Distance" (with David L. Kaserman and Patricia Pacey), May 1989.

Southwestern Bell Corporation "Annual Regulatory Conference" (St. Louis, Missouri)
  Presentation: "The New Regulatory Age - What Lies Ahead" April 1989.

University of Florida (Public Utility Research Center) Conference on "Beyond Traditional Regulation"
  Presentation: "Expectations and Realizations in Post-Divestiture Telecommunications Policy," February 1989.

National Conference of State Legislatures and the U.S. Advisory Commission on Intergovernmental Relations "Conference on Telecommunications Policy" (Washington, D.C.)
  Presentation: "Telecommunications Policy -- Past, Present and Future," November 1988.

University of Paris (Dauphine IX), Paris, France, EURO-TIMS, "Joint International Conference"
Presentation: "The Quantification of Entrepreneurship: The Determinants of Firm Entry, Exit, and Survival," July 1988.

University of Texas conference on "Current Issues in Telecommunications Regulation"
Papers Presented: "Deregulation and Market Power Criteria: An Evaluation of State Level Telecommunications Policy" (with David L. Kaserman), and "The Role of Cost Allocation Methodologies in the Deregulation of Long Distance Telecommunications," October 1987.

Rutgers University conference on "Interexchange Telecommunications and Regulatory Innovation"
Paper presented: "Long Distance Telecommunications Policy: Rationality on Hold" (with David L. Kaserman), October 1987.

University of Florida symposium on "Public Policy Toward Corporations"
Paper presented: "The Economics of Regulation: Theory and Evidence in the Post-Divestiture Telecommunications Industry" (with David L. Kaserman), March 1986.

CONSULTING:

U.S. Federal Trade Commission; Tennessee Valley Authority; AT&T; Sprint; MCI; Antitrust Division, Office of the Attorney General, State of Tennessee; U.S. Senator Howard Baker, Jr., U.S. Senate Majority Leader; Oak Ridge National Energy Laboratory, Oak Ridge, Tennessee; Arkansas Consumer Research; Division of Energy Conservation and Rate Advocacy, Office of the Arkansas Attorney General; U.S. Department of Energy

PROFESSIONAL PRESENTATIONS:

Targeted and Untargeted Subsidy Schemes: Evidence from Post-Divestiture Efforts to Promote Universal Telephone Service." Presented to the Southern Economic Association Annual Meetings, New Orleans, November 1995.

"Dominant Firm Pricing with Competitive Entry and Regulation: The Case of IntraLATA Toll," with Larry Blank and David L. Kaserman. Presented to the Southern Economic Association Annual Meetings, Orlando, Florida, November 1994.

"The Economic Welfare Effects of Extended Area Telephone Service," with Carlos Martins-Filho. Presented to the Western Economic Association Annual Meetings, Seattle, Washington, July 1991.

"Demand, Pricing and Regulation of Cable TV Services: Evidence from the Pre-Deregulation Period," with Yasuji Otsuka. Presented to the Southern Economic Association annual meetings, New Orleans, Louisiana, November 1990.

"Market Contestability: Toward an Operational Index," with David L. Kaserman. Presented to the Western Economic Association annual meetings, Lake Tahoe, Nevada, June 1989.

"The Political Economy of Deregulation: The Case of Intrastate Long Distance," with David L. Kaserman and Patricia Pacey. Presented to the Southern Economic Association annual meetings, San Antonio, Texas, November 1988.

"Barriers to Trade and the Import Vulnerability of U.S. Manufacturing Industries," with Don Clark and David L. Kaserman. Presented to the Southern Economic Association annual meetings, San Antonio, Texas, November 1988.

"Cross-Subsidization in Telecommunications: Economic Theory Versus Regulatory Rhetoric" with David L. Kaserman, Western Economic Association annual meetings, Vancouver, British Columbia, July 1987. Also presented at the Southern Economic Association annual meetings, Washington, D.C., November 1987.

"The Effects of Regulation on R&D: Theory and Evidence," Southern Economic Association annual meetings, New Orleans, Louisiana, November 1986.

"The Measurement of Vertical Economies and the Efficient Structure of the Electric Utility Industry" with David L. Kaserman, American Economic Association annual meetings, San Francisco, California, December 1983.

"Regulation, Advertising and Economic Welfare" (with David L. Kaserman), Southern Economic Association annual meetings, Washington, D.C., November 1983.

"Multiproduct Monopoly, Regulation and Firm Costs," Southern Economic Association meetings, Atlanta, Georgia, November 1982.

"Forecasting Economic Activity in Tennessee with a Quarterly Econometric Model," Southeastern Economic Analysis Conference, Charlotte, North Carolina, September 1982.

"The Technological Determinants of U.S. Energy Industry Structure." Regulatory Workshop, Center for the Study of American Business and the Department of Economics, Washington University, December 1981.

WORK IN PROGRESS:

"Regulation, Vertical Integration and Sabatoge," (with T.R. Beard and D.L. Kaserman), November 1996.

"Regulation and Investment: Evidence from the Electric Utility Industry," (with Thomas P. Lyon), March 1996.

"Regulatory Policies Toward Local Exchange Companies Under Emerging Competition: Guardrails or Speedbumps on the Information Highway," (with David L. Kaserman), revised June 1996.

"Targeted and Untargeted Subsidy Schemes: Evidence from Post-Divestiture Efforts to Promote Universal Telephone Service," (with Ross Eriksson and David L. Kaserman), revised November 1996.

"Modeling Entry and Barriers to Entry: A Test of Alternative Specifications," (with Mark L. Burton and David L. Kaserman), mimeograph, revised, August 1995.

"Open Entry and Local Telephone Rates: The Economics of IntraLATA Toll Competition (with David L. Kaserman, Larry R. Blank, and Simran Kahai), November 1996.

"Efficient Industry Structure and the Scope of Banking-Nonbanking Activities" (with Atul Saxena and Harold Black), January 1993.

"An Asymptotically Efficient Estimator for Point-to-Point Demand Models with Adjacent Cross-Sectional Correlation" (with Carlos Martins-Filho), August 1993.

Dominant Firm Pricing with Competitive Entry and Regulation: The Case of IntraLATA Toll (with David L. Kaserman and Larry R. Blank), May 1994.

EDITORIAL REVIEWER:

National Science Foundation, The MIT Press, Federal Trade Commission, The Economic Journal, Journal of Business, RAND Journal of Economics, Journal of Regulatory Economics, Review of Economics and Statistics, Economic Inquiry, Journal of Industrial Economics, Review of Industrial Organization, Scandinavian Journal of Economics, Eastern Economic Journal, Southern Economic Journal, Contemporary Economic Policy, Industrial Relations, Growth and Change, Review of Regional Studies, Journal of Economics and Business, Quarterly Review of Economics and Business, Journal of Policy Analysis and Management, Quarterly Journal of Business and Economics, Regional Science and Urban Economics, Financial Review, Journal of Money, Credit, and Banking, Social Science Quarterly, Telecommunications Systems, Public Finance Quarterly

PROFESSIONAL MEMBERSHIPS AND COMMITTEES:

American Economic Association
Western Economic Association
Southern Economic Association
American Law and Economics Association

National Regulatory Research Institute (Ohio State University), Research Advisory Committee

EXHIBIT JWM-2

CHART OF NUMBER OF LONG-DISTANCE
CARRIERS IN VARIOUS CITIES AND TOWNS

45920.1

Table 1. Number of Long Distance Carriers in Various Cities and Towns		
Major Metropolitan Areas	Population[1,2]	Long Distance Firms[3]
Baltimore	2,382,000	30
Denver	1,623,000	23
New York City	8,547,000	32
San Francisco	1,604,000	25
Milwaukee	1,432,000	22[4]
Salt Lake City	1.072.000	26
Smaller Communities		
Helena, Montana	24,569	14
Moose, Wyoming	100	18
Carthage, Tennessee	2,386	37
Hope, Arkansas	9.643	11

[1]U.S. Bureau of the Census. *Statistical Abstract of the United States: 1991* (111th edition), Washington, D.C., 1991.

[2]U.S. Bureau of the Census. *1990 Census of the Population: General Population Characteristics,*Washington D.C., May 1992.

[3]These are the firms given by the local exchange company business office as offering long distance telephone service on a "1+" basis.

[4]The local exchange company representative indicated that there were 11 "primary" long distance companies chosen by residential subscribers, but that all 22 carriers were available for subscription on a "1+" basis for Milwaukee customers.

SOURCE: David L. Kaserman and John W. Mayo "Long-Distance Telecommunications: Expectations and Realizations in the Post-Divestiture Period," in Incentive Regulation for Public Utilities, Michael A. Crew (Editor), Kluwer Academic Publishers, 1994.

EXHIBIT JWM-3

CHART OF NUMBER OF LONG-DISTANCE
## FIRMS PURCHASING EQUAL ACCESS

45923.1

Long-Distance Firms Purchasing Equal Access
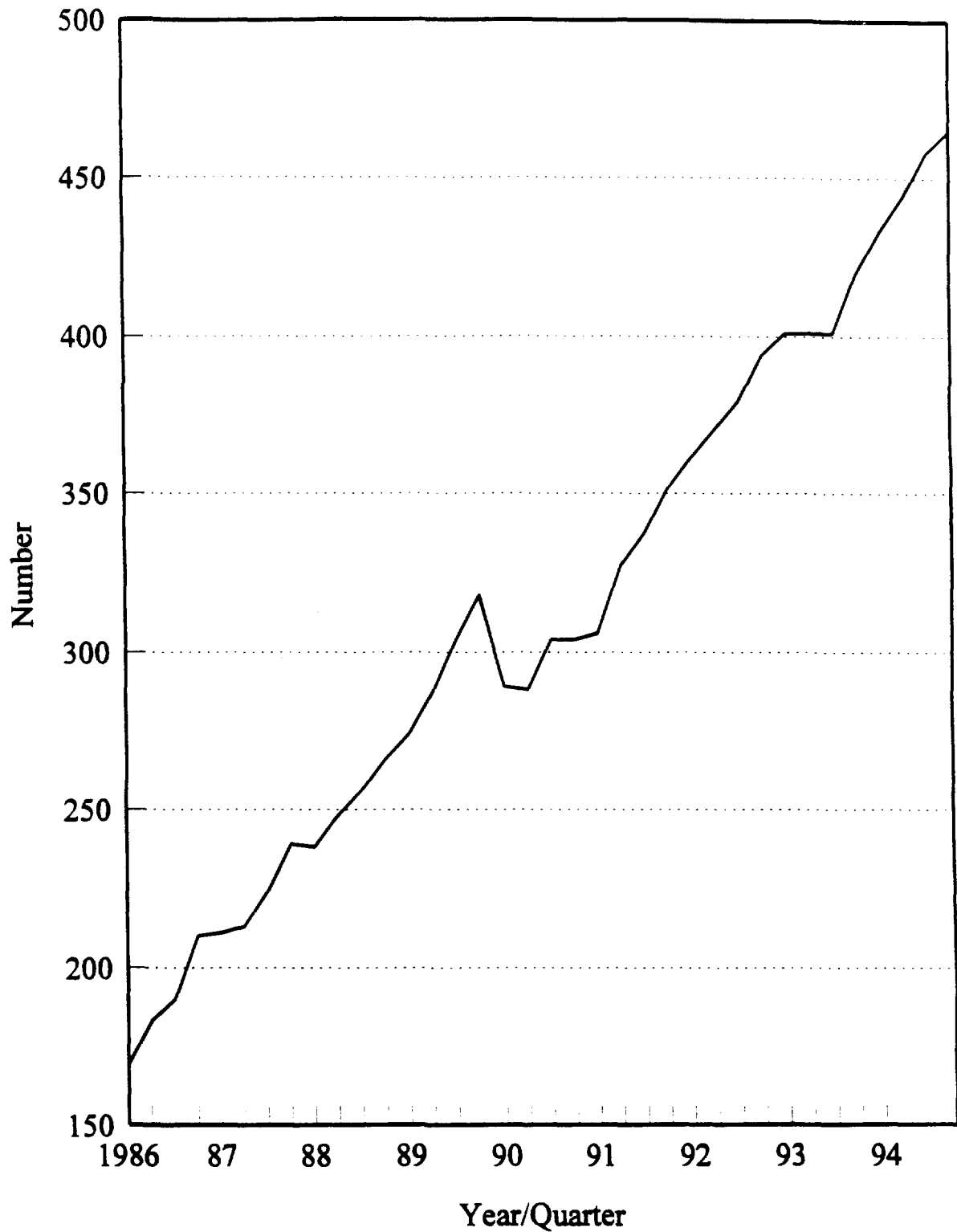
Source: "Long-Distance Carriers and Code Assignments," Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission, May 1995.

EXHIBIT JWM-4

**CHART OF DEPLOYMENT OF
INTEREXCHANGE COMPANY FIBER-MILES**

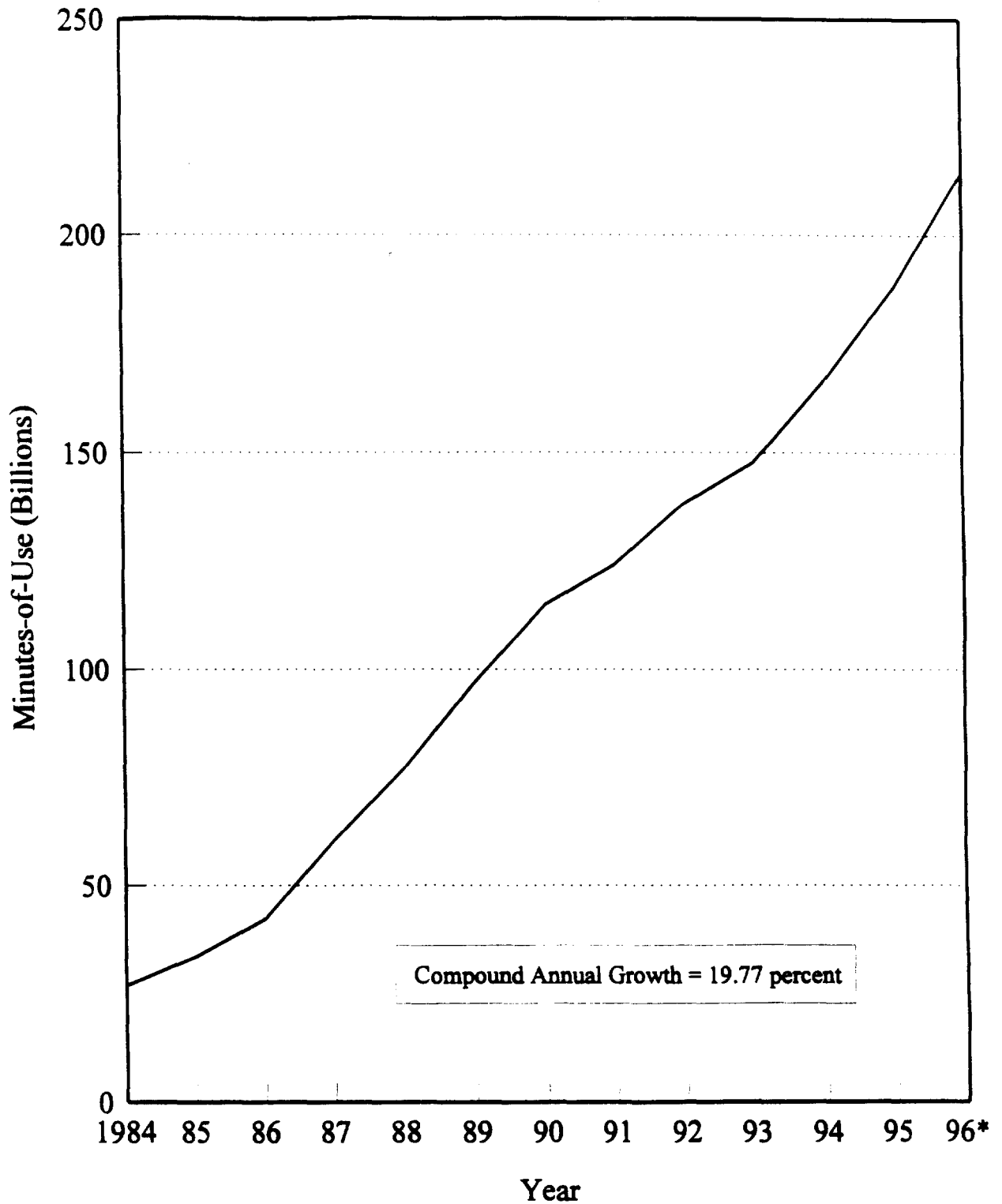45924.1

Deployment of Interexchange Company Fiber-Miles
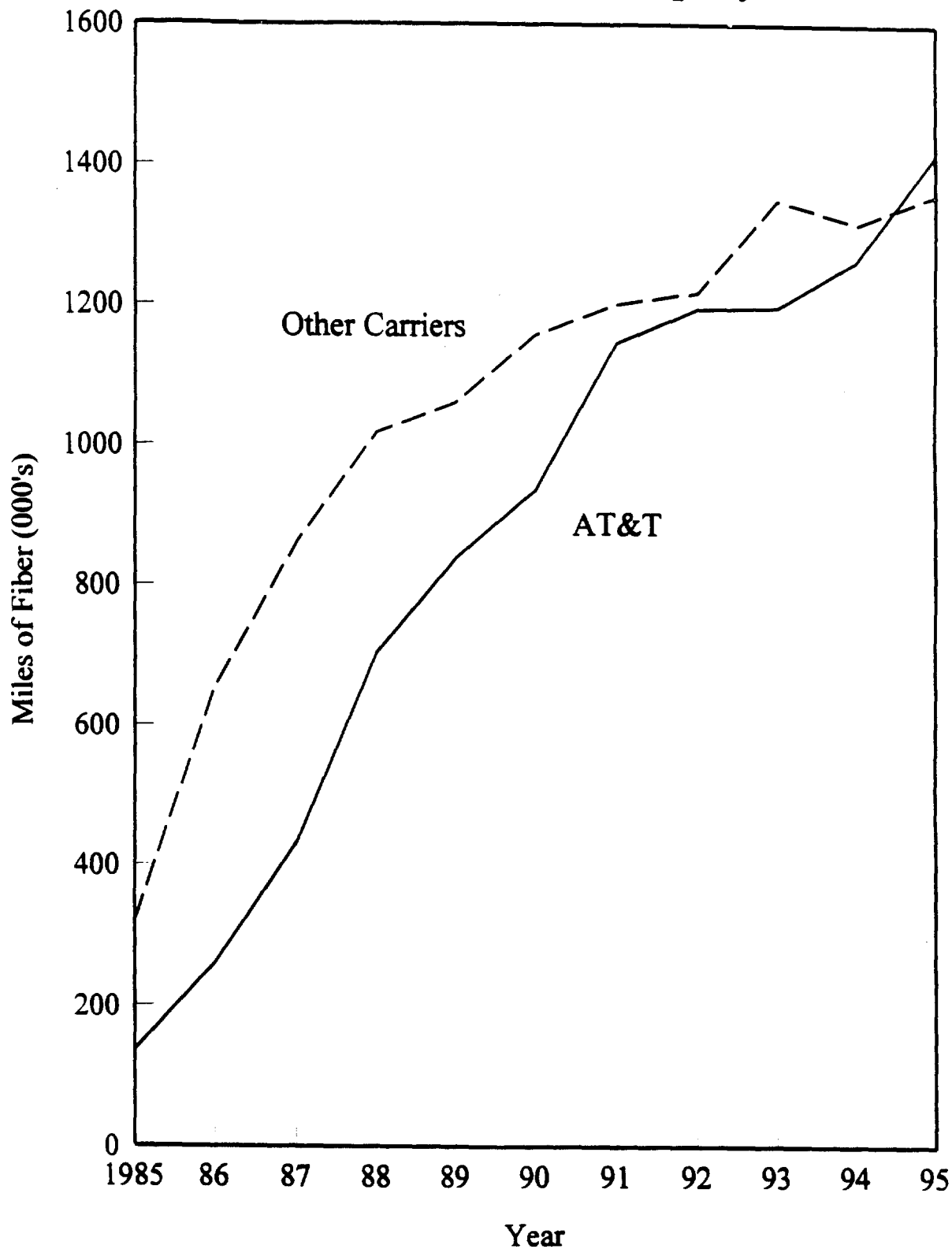
Source: Jonathan Kraushaar, "Fiber Deployment Update, End of Year 1995," Industry Analysis Division, FCC, July 1996.

MAYO031F.F5B

EXHIBIT JWM-5

CHART OF OUTPUT OF AT&T's COMPETITORS
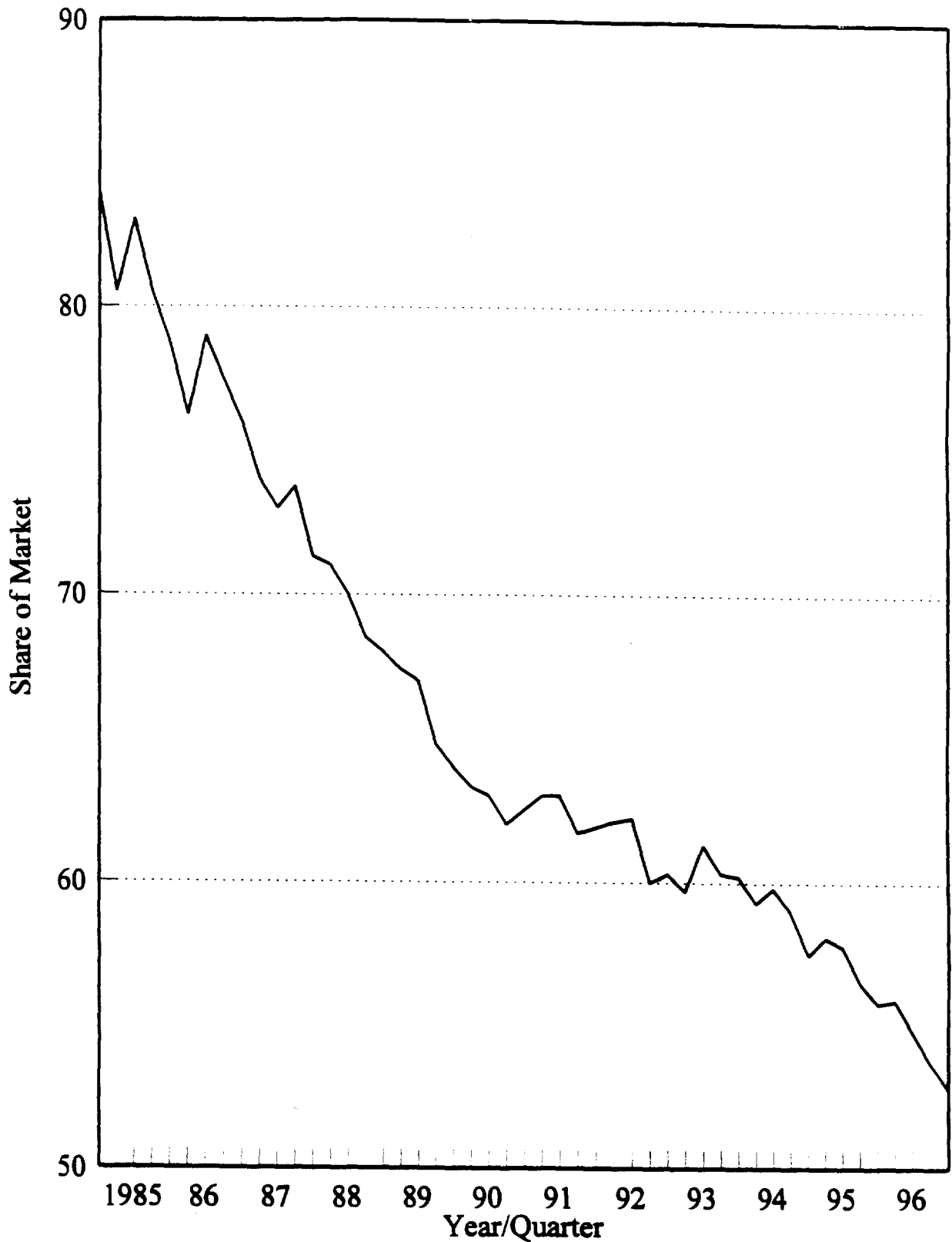
45925.1

Output of AT&T's Competitors

*Estimate based on annualized rate of output for first three quarters.

Source: "Long-Distance Market Shares, Third Quarter 1996, Industry Analysis Division, Common Carrier Bureau, January 1997.

EXHIBIT JWM-6

CHART OF AT&T's MINUTES-OF-USE-BASED MARKET SHARE

45926.1

AT&T's Minutes-of-Use-Based Market Share

MAYO031F.W03

EXHIBIT JWM-7

IS THE "DOMINANT FIRM" DOMINANT?
ALL EMPIRICAL ANALYSIS OF AT&T's MARKET POWER

Is the "Dominant Firm" Dominant?
An Empirical Analysis of AT&T's Market Power

By SIMRAN K. KAHAI,
DAVID L. KASERMAN,
AND JOHN W. MAYO

IS THE "DOMINANT FIRM" DOMINANT? AN EMPIRICAL ANALYSIS OF AT&T'S MARKET POWER*

SIMRAN K. KAHAI,   DAVID L. KASERMAN,
Auburn University   Auburn University

and

JOHN W. MAYO
University of Tennessee

ABSTRACT

In this article, we estimate the degree of market power held by AT&T in the interstate long-distance market in the postdivestiture period. Our approach makes use of the dominant firm/competitive fringe model to impose the structure needed both to obtain estimates of the relevant structural parameters and to translate these parameters into an estimate of AT&T's residual demand elasticity and associated Lerner index. Because of the continued presence of regulation and other considerations, however, a direct estimation of the residual demand elasticity is not feasible. Consequently, we take a more indirect approach that combines estimation of the elasticity of fringe firm supply, market demand estimation, and extant market share data to generate estimates of the desired elasticity. The resulting estimates strongly support the conclusion that AT&T lacks significant market power in the postdivestiture long-distance market.

I. INTRODUCTION

ONE of the most important policy issues in the telecommunications industry over the past decade and today has been the degree of market power held by AT&T. This issue has been the subject of extensive debate in regulatory hearing rooms throughout the country, before state and federal legislative bodies, and in the economics literature. Divergent opinions concerning this question have influenced regulatory decisions and legislative proposals ranging from relaxed regulation of this firm to removal of the restriction on entry by the Bell operating companies (BOCs) into the in-

terLATA market.[1] Indeed, it is difficult to imagine another applied microeconomics question that is likely to have as profound an effect on our public policy toward this industry in the coming years.

To date, however, virtually all evaluations of AT&T's market power have been based on a more-or-less traditional antitrust analysis of the market structure within which this firm operates.[2] That is, these evaluations have relied on evidence pertaining to structural characteristics such as market share and barriers to entry to reach judgmentally based conclusions about the degree of control over price that AT&T is likely to possess in a deregulated environment. Substantial differences of opinion have emerged from these analyses.[3] To a large extent, these differences may be traced to different implicit weights that the individual economists and regulatory agencies have attached to these various structural attributes (for example, market share versus entry conditions) and divergent expectations with respect to the likelihood of concerted action on the part of firms in this industry.

New developments in the economics literature over the past decade have

[1] This restriction is contained in the 1982 divestiture order. See Modification of Final Judgment, United States of America v. Western Electric Company and American Telephone and Telegraph Company, Civil Action No. 82-0192, with Revisions as of January 1, 1989. Most recently, the Telecommunications Act of 1996 defines conditions under which the Bell operating companies will be permitted to provide interLATA services. LATA is an acronym for local access and transport area.

[2] For an exception, see Michael R. Ward, Measurements of Market Power in Long Distance Telecommunications (staff report, Federal Trade Commission, Bureau of Economics, Washington, D.C., 1995).

[3] Several of these studies have appeared over the past few years reaching diametrically opposing conclusions regarding the intensity of competition in this market. Studies that argue that significant market power is present include Jerry A. Hausman, The Long Distance Industry Today (unpublished manuscript, Mass. Inst. Tech. 1993); Steven C. Salop, Steven R. Brenner & Gary L. Roberts, Market Power in the Supply of Long-Distance Services (unpublished manuscript, Charles River Associates 1990); Paul A. MacAvoy, Tacit Collusion under Regulation in the Pricing of Interstate Long-Distance Telephone Services, 4 J. Econ. & Mgmt. Strategy 147, 185 (1995); and William G. Shepherd, Long-Distance Telephone Service: Dominance in Decline? in Industry Studies (Larry L. Duetsch ed. 1993).

Studies that posit the presence of effective competition include Michael L. Katz & Robert D. Willig, The Case for Freeing AT&T, Regulation, 43, 49 (1983); David L. Kaserman & John W. Mayo, Long Distance Telecommunications Policy: Rationality on Hold, 122 Pub. Util. Fort. 18, 27 (1988); Michael E. Porter, Competition in the Long Distance Telecommunications Market (unpublished report, Monitor Company 1993); Robert E. Hall, Long Distance: Public Benefits from Increased Competition (unpublished manuscript, Applied Economic Partners, Menlo Park, Calif. 1993); David L. Kaserman & John W. Mayo, Long-Distance Telecommunications: Expectations and Realizations in the Post-divestiture Period, in Incentive Regulation for Public Utilities (Michael A. Crew ed. 1994); and David L. Kaserman & John W. Mayo, Competition and Asymmetric Regulation in Long-Distance Telecommunications: An Assessment of the Evidence, 4 Comm L. Conspectus 1, 26 (Winter 1996). These studies serve to highlight the importance of this debate and the glaring need for empirical work in this area.

produced an alternative, econometrically based, approach to the evaluation of market power.[4] Several alternative econometric techniques have been introduced to estimate the extent to which individual firms' output decisions influence market price. Implementing one or more of these techniques can, under certain conditions, yield an estimate of the price elasticity of the individual firm's residual demand curve. The inverse of this elasticity, then, provides a direct estimate of the Lerner index of the degree of monopoly power held by that firm.

In this article, we estimate the residual demand elasticity and associated Lerner index for AT&T in the interstate long-distance market in the postdivestiture period. Because of the continued presence of regulation and other considerations, however, direct estimation of this elasticity along traditional lines is not feasible. Consequently, we take a more indirect approach that utilizes estimates of the underlying components of the desired elasticity. This approach makes use of the dominant firm/competitive fringe (DF/CF) model to impose the structure needed both to obtain estimates of the relevant structural parameters and to translate these parameters into an estimate of AT&T's residual demand elasticity and Lerner index.

The resulting estimates strongly support the conclusion that AT&T lacks significant market power in the postdivestiture long-distance market. While such evidence is not likely to completely resolve the ongoing debate about the appropriate regulatory policy for this industry, it should contribute to the overall quality of that debate by adding an alternative empirical approach that is well founded in modern econometric methods of estimating market power.

The article is organized as follows. In Section II, we describe various conceptual considerations related to formulation of the empirical model. In Section III, we provide a description of the data and present our estimation results. The residual demand elasticity estimates and market power calculations are then reported and interpreted in Section IV. Finally, in Section V, we provide conclusions and discuss several caveats that accompany our analysis.

II. CONCEPTUAL CONSIDERATIONS AND MODEL SPECIFICATION

Under certain conditions, natural market events may generate data that allow researchers to draw inferences about the percentage departure of price from marginal cost, even though the relevant marginal opportunity costs are

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[4] See, for example, the papers included in the issue-length conference on "Empirical Approaches to Market Power," 32 J. Law & Econ. (October 1989). Also, see Timothy F. Bresnahan, Empirical Studies of Industries with Market Power, in 2 Handbook of Industrial Organization (Richard Schmalensee & Robert Willig eds. 1989).

generally unobservable. When such events occur, fairly generalized models of industry demand functions and individual firms' supply relations can yield estimates of structural parameters that shed light on the type of behavior exhibited by market participants, that is, whether the firms are colluding or competing.[5]

Within this class of models, an important approach has been estimation of firms' residual demand elasticities.[6] Because of the functional relationship that exists between the individual firm's price elasticity of residual demand and the Lerner index of market power, estimation of a company's residual demand curve provides a direct method of calculating the degree of market power it enjoys.[7] Therefore, to evaluate the extent of AT&T's market power in the postdivestiture long-distance market, we estimate the price elasticity of this firm's residual demand.[8] To provide the structure necessary to evaluate the degree of AT&T's market power in the interstate long-distance market, we make use of the DF/CF model. The principal assumptions of this model are (1) there is one firm that holds a relatively large share of the market (that is, the dominant firm); (2) there is a competitive fringe, consisting of a large number of much smaller firms, each of which takes the dominant firm's price as given; and (3) the product is homogeneous.

These assumptions appear to be reasonably well satisfied in the long-distance market during the time period covered by our data, 1984–93. First, during this period, AT&T continued to hold a relatively large share of the long-distance market. In particular, while there was a noticeable decline in AT&T's minutes-of-use market share, from 84 to 59 percent, the average share was 72 percent over this period.[9] As a point of reference, some eco-

[5] See Bresnahan, supra note 4, for a survey.

[6] See Jonathon B. Baker & Timothy F. Bresnahan, Empirical Methods of Identifying and Measuring Market Power, 61 Antitrust L. J. 3, 16 (1991). For an application of residual demand estimation, see Jonathon B. Baker & Timothy F. Bresnahan, Estimating the Residual Demand Curve Facing a Single Firm, 6 Int'l J. Indus. Org. 283, 300 (1988).

[7] Residual demand estimation has also been applied to the issue of market definition. See David T. Scheffman & Pablo T. Spiller, Geographic Market Definition under the U.S. Department of Justice Merger Guidelines, 30 J. Law & Econ. 123, 147 (1987).

[8] Direct estimation of residual demand in this market environment, however, is precluded. As explained by Baker & Bresnahan, supra note 6, at 7, estimation of residual demand functions requires identification of exogenous variables that shift one firm's marginal costs without affecting the costs of other firms in the industry. Firms competing in the long-distance market, however, all purchase essentially the same set of inputs at roughly equivalent prices. Consequently, AT&T has not experienced the sort of independent cost shifts that would allow identification of its residual demand curve from the available data. Additional structure must, therefore, be imposed on the model to permit this estimation.

[9] See Federal Communications Commission (FCC), Statistics of Communications Common Carriers, 1993/1994 ed. (released February 1995).

nomics literature suggests a threshold market share value of 40 percent in their treatment of the dominant firm model.[10] Also, consistent with the model's assumptions, during this period AT&T faced a considerably fragmented set of individually relatively small competitors. In 1986, AT&T faced roughly 170 competitors.[11] By 1993, that number had grown to 440.[12] At the beginning of the sample period, no single competitor to AT&T provided more than 6 percent of the interstate long-distance traffic.

As the industry structure has evolved over time, AT&T's two largest competitors, MCI and Sprint, have grown considerably. At the beginning of the sample period, the revenue-based market shares of these two firms were 5.5 and 2.6 percent, respectively. In 1988, these market shares were 10.3 and 7.2 percent, and by 1993 they had grown to 17.8 and 10.0.[13] The dominant firm model assumes that the fringe competitors are individually small enough that they accept the price of the dominant firm as given in determining their supply response. The classification of MCI and Sprint as fringe firms is admittedly a matter of judgment. We believe, however, it is justified by the relatively new positions of these firms in the market and their relatively small market shares during the period in question. As these firms continue to grow, it becomes increasingly less clear by the mid-1990s that the long-distance industry still conforms well to the assumptions of the DF/CF model.[14]

Another important benchmark for the application of the DF/CF model is the degree of product homogeneity. In a pure DF/CF model, all of the firms' products are perfectly homogeneous. Clearly, this is a simplifying abstraction that is rarely, if ever, met in empirical modeling. At the same time, application of the theoretical model should be applied to industries that at least approximately conform to the assumption. The relatively comparable levels of transmission speeds and quality, functions and features of

[10] See F. M. Scherer & David Ross, Industrial Market Structure and Economic Performance (3d ed. 1990).

[11] FCC, supra note 9.

[12] Id. Also, firm structure varies considerably across these competitors. Some carriers (for example, MCI and Sprint) are vertically integrated with both underlying transmission facilities and retail service offerings. Others participate exclusively at the wholesale stage (the so-called carriers' carriers,) or retail stage (that is, resellers).

[13] See Federal Communications Commission (FCC), Common Carrier Bureau, Industry Analysis Division, Trends in Telephone Service, February 1995.

[14] The observed evolution of the industry structure in the long-distance market is consistent with a literature beginning with Dean A. Worcester, Why "Dominant" Firms Decline. 65 J. Pol. Econ. 338, 346 (1957), wherein it is argued that the dominant firm case is inherently unstable and that such industries will, over time, evolve to alternative market structures Thus, the "window of opportunity" to analyze the long-distance, or any, industry in light of the DF/CF model may be innately limited.

long-distance calling in the postdivestiture period, together with an observed willingness of consumers to switch long-distance carriers, provides a relatively compelling prima facie case that consumers view long-distance services as essentially homogeneous.[15]

Additionally, however, the pure DF/CF model that assumes perfect product homogeneity may be modified to account for any tangible sources of product differentiation that may be part of the industry in question.[16] In the case of the long-distance market over the 1984–93 period, the primary source of product differentiation was the lack of dialing parity between AT&T and its competitors. Specifically, in the absence of switching upgrades by the local exchange companies, known as "equal access," AT&T uniquely enjoyed "1+" dialing at the time of the divestiture. In the absence of equal access, customers of all other long-distance companies were forced to dial additional digits to access their long-distance carrier before dialing the number of the party with whom they wished to speak. Beginning in 1984, and continuing throughout the sample period, however, local exchange companies have increasingly deployed equal access in their central office switches. By the end of the sample period, 97 percent of all telephone lines nationwide were converted to equal access.[17] Coincident with the proliferation of equal access and the increasing recognition of product homogeneity in the supply of long-distance services, the prices of these services have rapidly

[15] The comparability of the technical quality of long-distance service provided by interexchange firms is well established. See, for example, Mary Jander, Users Rate Long-Distance, 22 Data Comm. 89, 92 (1993). Evidence of consumers' willingness to switch long-distance carriers is found in Robert E. Allen, Testimony before the United States Committee on Commerce, Science and Transportation, Subcommittee on Telecommunications, September 8, 1993, wherein it is noted that in 1992, over 16 million customers switched their long-distance carriers. Advertising is a potential source of product differentiation. Several points, however, indicate that the advertising in the long-distance market is not a significant impediment to the applicability of the DF/CF model. First, virtually all industries engage in advertising. To the extent that advertising provides information regarding, say, pricing, its presence should not be a seen as indicative of significant product differentiation. Second, while advertising is common in the long-distance market, it was not, by U.S. advertising standards, "intense" during the sample period. For example, advertising to sales ratios for AT&T for the 1984–88 period were roughly 1 percent. No major carrier's advertising to sales ratio exceeded 5 percent over this period. See Porter, supra note 3. Finally, the proliferation of customer switching indicates that, although there is considerable effort by long-distance carriers to engender brand loyalty, advertising has not, in fact, created significant product differentiation.

[16] For examples of empirical DF/CF models that have successfully accounted for elements of intraindustry product differentiation, see Valerie Suslow, Estimating Monopoly Behavior with Competitive Recycling: An Application to ALCOA, 17 RAND J. Econ. 389, 403 (1986); and Larry R. Blank, David L. Kaserman, & John W. Mayo, Dominant Firm Pricing with Competitive Entry and Regulation: The Case of IntraLATA Toll (unpublished manuscript, Univ. Tennessee 1995).

[17] FCC, supra note 13, table 12, p. 20.

converged over time.[18] In sum, for the 1984–93 period, the fundamental characteristics of the long-distance market conform reasonably well with the assumptions underlying the DF/CF model. The empirical model specified below, however, accounts for any potential product differentiation in the long-distance market caused by the lack of ubiquitous equal access.

Given the DF/CF model, the residual demand curve faced by AT&T is given by the total market demand curve minus the collective supply curve of the competitive fringe; that is,

$$Q_{ATT}(P) = Q_M(P) - Q_F(P),$$ (1)

where P is the price of long-distance service, $Q_{ATT}(P)$ is AT&T's residual demand, $Q_M(P)$ is market demand, and $Q_F(P)$ is fringe supply. Due to the price-taking behavior exhibited by fringe producers, $Q_F(P)$ is given by the collective marginal cost curve of these firms. Equation (1) may be manipulated to obtain the dominant firm's residual demand elasticity as a function of three underlying structural parameters:

$$\eta_{ATT} = \frac{\eta_M}{S_{ATT}} + \frac{(1 - S_{ATT})\epsilon_F}{S_{ATT}},$$ (2)

where η_{ATT} is AT&T's residual demand elasticity, η_M is the market demand elasticity, S_{ATT} is AT&T's market share, and ϵ_F is the price elasticity of fringe supply.[19]

Equation (2) may be used to calculate η_{ATT} from prior estimates of three underlying structural parameters—η_M, ϵ_F, and S_{ATT}. Estimates of S_{ATT} and η_M are readily available in the published literature. No such estimates of ϵ_F, however, exist. In fact, one could argue that the absence of such an estimate is the principal source of the ongoing debate regarding the intensity of competition (and, therefore, optimal regulatory policy) in this market. Therefore, in order to implement equation (2), we must first estimate the price elasticity of fringe supply.

Toward this end, we specify a simultaneous model of competitive fringe supply and market demand in the interstate long-distance market. The the-

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[18] See Kaserman & Mayo, Long-Distance Telecommunications, *supra* note 3, for evidence of convergence of prices for intrastate toll services. A similar convergence has occurred for interstate services. Indeed, a review of the rates charged for basic residential message toll service between various locations in 1993 reveals that the these prices for AT&T, MCI, and Sprint are virtually identical. See FCC, *supra* note 9, tables 7.1–7.3.

[19] See Thomas R. Saving, Concentration Ratios and the Degree of Monopoly, 11 Int'l Econ. Rev. 139, 146 (1970).